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June 20, 1997

VIA HAND DELIVERY

Ms. Kathleen O'Brian Ham
Chief, Auctions Division
Wireless Telecommunications Bureau
Federal Communications Commission
2025 M Street, N.W., Room 5322
Washington, D.C. 20554

Re: Rulemaking To Amend Parts 1, 2, 21, and 25 Of the Commission's Rules to Redesignate The 27.5-29.5 GHz Frequency Band, To Reallocate the 29.5-30.0 GHz Frequency Band, To Establish Rules and Policies for Local Multipoint Distribution Service And for Fixed Satellite Services
CC Docket No. 92-297

Dear Ms. Ham:

DigiVox Telecom, Inc. ("DigiVox") hereby submits its comments regarding up-front payments for the Local Multipoint Distribution Service ("LMDS") auction as addressed in the Commission's Second Report and Order, Order on Reconsideration, and Fifth Notice of Proposed Rulemaking, CC Docket No. 92-297 (Adopted March 11, 1997) (the "Report and Order") at ¶¶ 328-330 in the above-referenced proceeding.

Specifically, DigiVox agrees with the Commission that for purposes of LMDS, the formula of $0.02 per MHz-pop can yield excessively high up-front payments given the amount of spectrum offered in each service area, and it agrees that the Commission therefore should lower the $0.02 per MHz-pop that is generally used to calculate up-front payments.

The up-front payment formulas used by the Commission in its most recent auctions have had anomalous results. For example, in the auctions for the D and E blocks of PCS spectrum, the up-front deposit required exceeded the amount of the net present value of the purchase price paid for the licenses for over 17 percent of the licenses offered.

The up-front payments for the LMDS auction should not be assessed in the same proportion to the amount of spectrum as was assessed in the Commission's D, E, and F block PCS auctions. While individual applications will be bidding for a much greater amount of spectrum per market in the LMDS auction than did bidders in the D, E, and F block PCS auctions, the end-users of the LMDS services will typically pay much less per MHz of spectrum than will customers of PCS providers. As a result, equity mandates that the Bureau base the levels of up-front payments in the LMDS auctions on the amount of income the licenses are expected to generate and the amount that successful bidders are expected to pay for LMDS licenses rather than on the amount of spectrum that each license will comprise.

It is imperative that the Commission bring the level of up-front payments back down to earth to a level that serves as the least restrictive means by which to deter insincere and speculative bidders as well as those who do not have the financial capability to build out their systems. The formulas most recently applied by the Commission have gone beyond their intended purpose of precluding participation of insincere bidders to also preclude the participation of sincere bidders who are financially and otherwise prepared to offer competitive services to the public. This would have a devasting impact on the outcome of the LMDS auction. In Appendix D (page 10) of the Second Report and Order, the Commission estimated that small businesses would constitute at least 92% of all LMDS applicants. These bidders will be severely and irreparably harmed if the Commission does not modify its standard formula.

For these reasons, and for reasons more fully set forth in the attached report of Ronald M. Harstad, Ph.D., DigiVox hereby urges the Bureau[1] to adopt a payment formula of 0.75 mils ($0.00075) per MHz pop. Even at this low level, the up-front payment for the 1150 MHz license for the Los Angeles BTA would be over $12.5 million. As set forth in Dr. Harstad's report, the solution proposed by DigiVox will not only deter the entry of frivolous bidders into the auction process, but it will also facilitate the participation of serious bidders, particularly small business entities, that otherwise would be unnecessarily precluded from participation by the unconscionably high up-front payment that would be required under the Commission's generally applicable formula.

It is therefore respectfully requested that the Commission adopt the up-front payment formula proposed by DigiVox in this filing. Should there be any questions regarding this matter, please contact the undersigned.

Very truly yours,

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President, DigiVox Telecom, Inc.

cc: Dan Phythyon
Dorothy Conway
Timothy Fain
Bob James
Mark Bollinger
Joseph Levin
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[1] This request is being filed with you pursuant to paragraph 330 of the Report and Order, which delegates to the Chief of the Wireless Telecommunications Bureau (the "Bureau"), the authority to determine an appropriate calculation for the up-front payment that will be required of bidders in the LMDS auctions.

Attachment 1

Up-front Payments for the LMDS Auction:
An Analysis and Recommendation

Ronald M. Harstad, Ph.D.

June 19, 1997

High up-front payments are a significant deterrent to participation in radio spectrum auctions. The quadrupled up-front payments for the D, E, and F block auction (over the C block) notably reduced participation. Similarly, the absurdly high level of up-front payments for the WCS auction prevented several intended bidders' participation, among them DigiVox Telecom, Inc.

Disenfranchising these bidders cannot enhance revenue, and is likely to be inconsistent with the 309.J mandate to auction spectrum to the most efficient users. (It is neither politically nor economically tenable to assume that the most efficient users are necessarily those willing and able to make the largest up-front payments.)

Small businesses are particularly disadvantaged. Often, the smaller bidders are competing for less-desired licenses, in less populous geographic areas, and the up-front payments are a higher fraction of ultimate prices for those licenses. To cite but one of thousands of examples, in the A/B block PCS auction, up-front payments amounted to 2% of the cost of the Chicago licenses, but to more than 20% of the cost of the Guam, Alaska, and Omaha licenses.

The Congressional mandate to ensure competition has made it even more important lately to encourage small bidders to participate in the LMDS auction. The merger news of the last few weeks makes it clear that the major telecommunications firms can be counted on to seek consolidations and alliances rather than increase competition. Small firms may be the principal hope for LMDS licenses to be put to use offering wireless local loop and/or multi-channel video services in competition with local monopolies. In the Second Report and Order, the Commission estimated that small businesses would constitute 92% of LMDS applicants.[1]

One clear sign that small bidders are being barred from auctions by high up-front payments arises when the prices of licenses requiring great up-front payments fall too far behind, on a price-per-pop basis, licenses with lesser up-front payment requirements. Table 1 illustrates this phenomenon. The occurrence is quite broad, here shown simply for two mid-sized cities, Cincinnati and Kansas City, that in the A/B block auction sold for noticeably lower prices per pop than Los Angeles, and two cities that sold at near-Los-Angeles prices, Phoenix and Kansas City. (These four cities were chosen without looking at the data for later auctions, or the identity of winning bidders in any auctions.)

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[1] This estimate of applicants intending to provide non-common-carrier services comes from Appendix D, Final Regulatory Flexibility Analysis, page 10.

Table 1

Selected Mid-Size Market Prices,
Relative to Los Angeles, Across Auctions

Block	A/B (avg)	C	D/E (avg)	F	WCS
Los Angeles	$ 25.78	$ 34.86	$ 2.39	$ 0.21	$ 0.016
Cincinnati	$ 8.98	$ 26.66	$ 4.75	$ 2.70	$ 0.076
(ratio)	**(0.35)**	**(0.77)**	**(1.99)**	**(12.92)**	**(4.74)**
Kansas City	$ 8.11	$ 24.65	$ 2.73	$ 0.76	$ 0.004
(ratio)	**(0.31)**	**(0.71)**	**(1.14)**	**(3.65)**	**(0.28)**
Phoenix	$ 21.93	$ 56.50	$ 4.38	$ 8.53	$ 0.039
(ratio)	**(0.85)**	**(1.62)**	**(1.83)**	**(40.90)**	**(2.43)**
Seattle	$ 27.63	$ 56.18	$ 2.77	$ 2.56	$ 0.0048
(ratio)	**(1.07)**	**(1.61)**	**(1.16)**	**(12.25)**	**(0.30)**

Prices are per pop, net present values, for comparability across auctions; ratio is price divided by Los Angeles price. Licenses are MTAs (A/B), BTAs (C-F), and MEAs.

By and large, the bidders in the A/B auction were large corporations and alliances for whom up-front payments were not a constraint, so that the ratios found in this column (in parentheses) are presumably rough reflections of the underlying demographic and socioeconomic characteristics representing the market opportunity. That is, incorporating the effects of bidding competition, a license for Cincinnati was worth, per pop, approximately 35% and Seattle approximately 107% of what the Los Angeles license was worth.

All the ratios go up when we switch to looking at the C block auction. A few relevant aspects have changed, most notably the number of Los Angeles licenses being auctioned now is the same as the other cities rather than half the number, and the redefinition of all the geographic regions to focus more narrowly on the named city (BTAs rather than MTAs). But a significant part of the reason for the higher ratios is the increased difficulty the entrepreneurs bidding in the C block encountered to raise even the $0.45 per 30MHz pop up-front payment to bid on Los Angeles. The liquid capital needed to get into the bidding was less for the other C licenses shown, leading to higher prices for them, relative to Los Angeles. The price ratio doubled for nearly all but Seattle.

The remainder of the auctions shown are for 10MHz licenses, awarded later, and with more incumbents; none of these changes should be relevant to the ratios. However, the D, E, and F block auction quadrupled up-front payment requirements, with very little notice to bidders. The results were (with Seattle an exception) showing a strain even on the bidders in the D and E blocks, which were not eligible for small-business preferences.

However, the real story of that auction is the F block, where small businesses had very little time to raise funds for onerous up-front payments, particularly if they were to

compete for an area as populous as Los Angeles. Bidding competition was thus more acutely lacking for Los Angeles, which went for a price that was 1/12th of the price of Cincinnati or Seattle, 1/40th of Phoenix. Taxpayers suffered, and entrepreneurial firms that would have competed suffered, because of the ungainly barrier to entry imposed by the inordinately high up-front payments.

The numbers for the WCS auction are more wild than useful. The FCC set barriers to entry at ridiculous levels in two ways: the up-front payments required, and the requirement that, of the time between the Congressional mandate being promulgated and the required start of the auction, the FCC used 98% of that time to set the rules and left the bidders only 2% of the time to raise the funds. Is it an auction or a firesale when the price of $1 for every baker's dozen Cincinnati denizens is still nearly 5 times as high as Los Angeles, and the Kansas City license goes for a buck per each 250 residents?

The original notion behind requiring up-front payments was that of a deposit, roughly akin to the treatment in layaway sales in bargain stores. A portion of the eventual purchase price is paid at the beginning to signify the purchaser's seriousness. In auctions, setting the up-front portion is complicated by not knowing the ultimate purchase price. However, to the extent possible, the FCC ought to be aiming for 2-3% of the purchase price; any higher and the up-front payment becomes more of an entry barrier than simply a serious-bidder identifier. Unfortunately, there are hundreds upon hundreds of examples that show the FCC staff who have recently taken over setting up-front fees are nowhere near the ballpark of serious-bidder identification. Indeed, they have taken up-front payments well past the role of a deposit.

Table 2 illustrates. The examples given are not random, but are far from the most extreme examples available. The D, E, and F blocks are studied, illustrating via the three licenses for Los Angeles and for Syracuse, plus 5 other F block licenses. The $8.7M up-front payment for the Los Angeles D and E blocks was clearly excessive, but ¼ of the purchase price is technically still a deposit. However, on all the other licenses shown, and indeed on over 20% of the licenses offered (298 out of 1479 licenses), **the deposit was above the net present value of the purchase price!** For D and E block licenses, the figure was 17% (168 out of 986 licenses); and for fully 27% (129 out of 493) of F block licenses, the deposit was above the net present value of the purchase price. Indeed, the end of the auction saw the FCC returning deposits not only to auction losers, but also to winners. Harmlessly ignoring the aggregation across licenses of refund checks to bidders, the Los Angeles F-block winner had to raise and deposit $8.7M in cash to be allowed to bid for the license, but $7.8M of that was refunded to it after the auction, with less than $900,000 remaining with the FCC as its 20% down payment. In present value terms, the bidder was paying only $3M, so the FCC would, over the next 10 years, collect the equivalent of another $2.1M. To bid on that license, however, a firm had to raise in liquid capital 288% of what was needed to fully purchase the license, and almost 1,000% of what was needed at the end of the auction to initially obtain the license.

In Pittsburgh and Watertown, the funds the FCC required a bidder to deposit up-front fees that were more than 1100% of what it took to buy the license. The Pittsburgh license was purchased with $39,000 cash, and the presumed ability to raise, within 10

Table 2

Block	License	Upfront Payment	Net Price	Downpayment	Refund at Auction End	NPV of Debt	Upfront as % of NPV	Amount Owed	Net Refund	NPV Price
D	Los Angeles	$ 8,729,886	$ 37,510,000	$ 7,502,000	$ 1,227,886	$ 30,008,000	23%	$ 30,008,000	$ -	$ 37,510,000
E	Los Angeles	$ 8,729,886	$ 31,910,000	$ 6,382,000	$ 2,347,886	$ 25,528,000	27%	$ 25,528,000	$ -	$ 31,910,000
F	Los Angeles	$ 8,729,886	$ 4,473,750	$ 894,750	$ 7,835,136	$ 2,141,548	288%	$ 3,579,000	$ 4,256,136	$ 3,036,298
F	Pittsburgh, PA	$ 1,504,703	$ 195,000	$ 39,000	$ 1,465,703	$ 93,345	1137%	$ 156,000	$ 1,309,703	$ 132,345
F	Watertown, NY	$ 177,752	$ 22,500	$ 4,500	$ 173,252	$ 10,771	1164%	$ 18,000	$ 155,252	$ 15,271
F	Binghamton, NY	$ 213,987	$ 60,008	$ 12,002	$ 201,985	$ 28,725	525%	$ 48,006	$ 153,979	$ 40,727
F	Minneapolis	$ 1,704,337	$ 1,499,258	$ 299,852	$ 1,404,485	$ 717,683	167%	$ 1,199,406	$ 205,079	$ 1,017,534
F	La Crosse, WI	$ 177,461	$ 90,000	$ 18,000	$ 159,461	$ 43,082	291%	$ 72,000	$ 87,461	$ 61,082
D	Syracuse, NY	$ 474,684	$ 264,000	$ 52,800	$ 421,884	$ 211,200	180%	$ 211,200	$ -	$ 264,000
E	Syracuse, NY	$ 474,684	$ 245,000	$ 49,000	$ 425,684	$ 196,000	194%	$ 196,000	$ -	$ 245,000
F	Syracuse, NY	$ 474,684	$ 245,000	$ 49,000	$ 425,684	$ 117,280	285%	$ 196,000	$ 229,684	$ 166,280

years, the equivalent of $93,000 current dollars. But to be allowed into the auction, the required deposit was not some fraction of the $39,000, but rather almost 40 times as much cash. Moreover, if an investor did not want to commit himself to a stake in the small bidder before the FCC announced the final rules for the auction, on June 24th, 1996, this pointless cash hoard had to be raised in about 6 weeks.

There are a number of cases where the FCC required less extreme (but still purposeless) deposits on the order of 50-80% of the license's ultimate price, and about 20% where the bidding was aggressive enough that the government did not have to send a check to the winner after the auction. But those who might claim I am picking the most unflattering cases to present are way off the mark: I am letting pass the WCS fiasco, when the up-front payments reached into the ionosphere of 4,000,000% more than the license price (e.g., San Francisco).

Up-front payments were originally incorporated as an attempt to limit the auction to serious bidders. In pursuing this valid target, the FCC started with a shotgun, but has since gone nuclear. And this is for a target that can readily be seen to have less mobility than a snail. Bidders who are operating on highly limited finances actually present only insignificant problems for the auctions: on any nonnegligibly demanded license, their resources quickly drop them out of the running. The FCC has other tools to keep them from bidding beyond their resources, including withdrawal and default penalties. That is not a purpose for which up-front payments are an appropriate tool.

An Additional Tool

This brief closes with a conservative recommendation for LMDS up-front payments. The FCC is urged to set them no higher than recommended below. However, if the FCC is really convinced that using such reasonable levels for up-front payments leaves the auction open to frivolous bidding, this concern would be better addressed via an additional tool than by higher up-front payments. The additional tool would be a *flexible deposit* requirement. The amount of money on deposit with the FCC at the beginning of the auction would establish an eligibility limitation, which would never ease during the auction. The amount of money on deposit at any time during the auction would also limit the total bidding exposure of any bidder; however, this constraint could be eased simply by depositing further funds.

To simplify an illustration, assume a bidder was only interested in the 1150-MHz bandwidth LMDS licenses. Suppose the bidder made an up-front payment of $8,650,000. Then, under the recommendation below, this would make the bidder eligible for bidding on 1150-MHz LMDS licenses totaling 10,000,000 pops. Further deposits as the auction proceeded would not increase this eligibility. Suppose a 2% flexible deposit requirement were also in effect. Then, based on this up-front payment, the bidder would be eligible to submit bids as desired, so long as the total of current high bids and newly submitted bids were no more than $432.5M, as at least 2% of the total exposure would be covered by the up-front deposit. If the bidder wished to bid higher, for example $67.5M higher, up to a total of $500M, it would have to deposit a further $1,350,000, to

bring its total deposit up to 2% of the total amount it wished to bid on all licenses it sought.

My recommendation is that the Commission **not** institute a flexible deposit requirement. It adds to complexity, with very little benefit. Most important, though, are the myriad unforeseen effects on bidders' strategies. It is not easy to work through what the overall prediction would be regarding how a flexible deposit requirement would affect bidding and auction outcomes. One serious possibility is that a firm could signal rivals an aggressive posture by adding to its deposit. A firm which jump bid for a license, bidding say $25M when the minimum bid was $19M, has sent a strong signal to other bidders for that license. But in order to make the signal, at least the firm has had to make a commitment to the FCC for an additional $6M for this license. If a 2% flexible deposit requirement gave it the alternative of making the minimum bid while increasing its deposit, it could extend its ability to bid by $6M via an additional deposit of only $120,000. This makes the signal far less costly: The deposit will go toward a downpayment or be refunded, and the bidder has not had to commit himself to paying the extra $6M. Notice that a jump bid is a clear signal about a particular market; a new deposit does not indicate in which market the bidder wants to relax the flexible deposit constraint. This might sometimes make the message less effective, but also sometimes have the reverse impact: a bidder could signal aggressiveness to several rivals in several markets by adding to its deposit.

Nonetheless, the poorly understood downside of instituting a flexible deposit requirement is better than the well understood and serious downside of setting up-front payments too high.

Relationship to Bandwidth

There is a fallacy that claims up-front payments ought to be roughly proportional to bandwidth being offered. If this fallacy had any merit, it would stem from [a] customers being willing to pay monthly fees proportional to bandwidth, or [b] the number of customers a licensee can attract, without lowering prices, being proportional to bandwidth. Of course, [a] has the implication that a customer willing to pay $40/month to a cellular incumbent (with 25 MHz) would be willing to pay $1,840/month to switch to an LMDS licensee (who has 46 times as much bandwidth). Nor is [b] less farfetched; it implies that a cellular incumbent who currently has signed up 2% of all households in a BTA could sign up 94% of the households if it only purchased an 1150-MHz LMDS license. If this fallacy had any merit, if 1 MHz bandwidth were the same fungible commodity regardless of where it fell on the spectrum, the first whiff of an FCC intention to offer an 1150 MHz license would have wiped out all interest in any smaller bandwidth offerings.

What Needs to Be Done?

1. The Commission failed to provide bidders even a third of the time necessary to create business plans and attract investors before the up-front payments deadline for the F block auction. This time, the Commission ought to ensure that all aspects of the LMDS rules which might reasonably be unaffected by the RBOC legal challenges now underway, be finalized, announced and available on the internet at least 4 months before the up-front payments deadline.

2. Up-front payments for the LMDS auctions need to be brought back down to earth. My analysis suggests that setting LMDS up-front payment levels any higher than 1 mil per MHz-pop is tantamount to failing to learn from the auctions to date. My recommendation is 0.75 mils per MHz-pop; this still amounts to an up-front payment of over $12.5 million for the 1150 MHz license for the Los Angeles BTA.

Ronald M. HARSTAD

Curriculum Vitae

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Current Affiliations:

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Associate Professor of Economics, Faculty of Management, 1993-
Fellow, RUTCOR (Rutgers Center for Operations Research), 1992-
Associate, Center for Research in Regulated Industries, 1993-
Member, Graduate Faculties, New Brunswick and Newark, 1993-

International Journal of Game Theory

Member, Editorial Board, 1992-
Area Editor, "Games and Experiments", 1995-
Journal's sole autonomous area editor

Journal of Regulatory Economics

Member, Editorial Board, 1993-96

Research Fields (Journal of Economic Literature classifications):

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Teaching Specialties:

Microeconomic Theory, Industrial Organization, Public Finance

Consulting:

Bidding consultant to SBC Communications and Southwest Bell Mobile Systems, radio spectrum auctions (FCC PCS MTA), 1994-95

Grants:

1993 Co-Principal Investigator, National Science Foundation grant, SBR 93-09333, "Enriched Modeling of Auctions and Bidding," (with M. H. Rothkopf).

1991 Co-Principal Investigator, National Science Foundation grant, SES 91-08551, "Enriched Modeling of Auctions and Bidding," (with M. H. Rothkopf), funded for two years.

1984 Co-Principal Investigator, National Science Foundation grant, IST 84-08396, "The Role of Information and Information Processing in Auctions: Theory and Experimentation," (with J. H. Kagel and D. Levin), funded for two years.

1979 Project Director, National Science Foundation grant, SES 79-15356, "Interactive Behavior Experimentation," (with J. K. Murnighan, A. E. Roth, F. Schoumaker), renewed 1980, 1981, 1982.

Publications:

Refereed Articles:

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"Implementation of Mechanisms by Processes: Public Good Allocation Experiments" (with M. Marrese), *Journal of Economic Behavior and Organization*, 2 (1981), 129-51.

"Expected-Utility-Maximizing Price Search with Learning" (with A. Postlewaite), *Management Science*, 27 (1981), 75-80.

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"Efficiency and Incentive Compatibility When Bidders Have Private Information about Competitors" (with M. H. Rothkopf and K. Waehrer), pp. 1-13 in: M. R. Baye (ed.), *Advances in Applied Micro-Economics*, Volume 6, *Auctions*, JAI Press, Greenwich, Ct., 1996.

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"Interaction Between Resource Extraction and Futures Markets: A Game-Theoretic Analysis" (with L. Phlips), pp. 289-307 in Volume II of: R. Selten (ed.), *Game Equilibrium Models*, Springer, Berlin, 1991.

"Perfect Equilibria of Speculative Futures Markets" (with L. Phlips), pp. 157-74 in J. J. Gabszewicz, J.-F. Richard and L. A. Wolsey (ed.), *Economic Decision-Making: Games, Econometrics and Optimisation - Contributions in Honour of Jacques Dreze*, Elsevier Science Publishers, 1990.

Publications in an Editorial Capacity:

"Laboratory Investigations of Expectations in Games: The Amsterdam Papers," *International Journal of Game Theory*, forthcoming.

"Introduction to Methods, Morals and Markets," pp. 3-8 in Volume II of: R. Selten (ed.), *Game Equilibrium Models*, Springer, Berlin, 1991.

Contributions to Conference Volumes:

"Franchise Bidding with Vickrey Auctions" (with M. A. Crew), pp. 117-30 in M. A. Crew (ed.), *Innovative Approaches to Utility Regulation*, Kluwer Academic Publishers, 1992.

"Dual Ceteris Paribus Comparisons: Some Initial Thoughts on Laboratory Isolation of Equilibrium Forces in Auction Markets," pp. 173-83 in: R. Tietz, W. Albers and R. Selten (ed.), *Modeling Bounded Rational Behavior in Experimental Games and Markets*, Springer, Berlin, 1988.

Papers in Requested Revise-and-Resubmit Status:

"Computationally Manageable Combinational Auctions" (with M. H. Rothkopf and A. Pekec).

"Auction Form Preferences of Risk-Averse Bidtakers" (with K. Waehrer and M. H. Rothkopf).

"Franchise Bidding without Holdups: Utility Regulation with Efficient Pricing and Choice of Provider" (with M. A. Crew).

"Oligopolistic Manipulation of Spot Markets and the Timing of Futures Market Speculation" (with L. Phlips).

Papers Currently Submitted:

"Is Subsidizing Inefficient Bidders Actually Costly?" (with M. H. Rothkopf and Y. Fu).

"Experimental Design and Elicitation of Values" (with G. W. Harrison and E. E. Rutström).

"Combinational Auctions with Synergies" (with M. H. Rothkopf).

"Dominant Strategy Adoption, Efficiency, and Bidder's Experience with Pricing Rules."

"Efficiency of Area-Wide Oil Leasing with a Constrained Public Budget" (with M. H. Rothkopf).

Papers Currently Circulating for Comment, and in Preparation for Submission:

"Auctions with Endogenous Bidder Participation."

"An Alternating Recognition Model of English Auctions" (with M. H. Rothkopf).

"Competitive Bidding Magnifies Adverse Selection" (with R. F. Bordley).

"The Way It Is: Exercise of Governmental Monopoly Power Given a Distortive Tax System" (with M. H. Rothkopf).

"Reasoning without Common Knowledge of Reasoning."

Prior Appointments:

1987-1993 Virginia Commonwealth University
Associate Professor of Economics

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1977-1981 University of Illinois at Urbana-Champaign
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Temporary Appointments:

1995, Fall University of Bonn, Germany
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1995-1996 University of Virginia
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Refereeing:

Referee in last 5 years on over 100 occasions for over 30 scholarly journals and societies, research foundations, and University tenure committees

Official Positions in Scholarly Organizations:

Economic Science Association:
Member, Task Force on the Creation of a Journal of Experimental Economics, 1991-93.

Econometric Society:
Program Committee Member, 1983 Winter Meetings and 1979 Summer Meetings

Public Choice Society:
Program Committee Member, 1980 and 1981 Annual Meetings

Midwest Mathematical Economics Society:
Conference Organizer, Fall 1978 Meetings

Dissertation Supervision:

Supervisor, co-supervisor or dissertation committee member in the 1990s for a dozen PhD students at universities in four nations

Teaching Experience:

Both Graduate and Undergraduate: Mathematical Economics, Microeconomic Theory, Experimental Economics, Game Theory, Industrial Organization, Public Finance, Managerial Economics.

Graduate: Operations Research, Modeling and Analyzing Auctions and Bidding.

Undergraduate: Intermediate Microeconomics, Microeconomic Principles, Economics of Regulation.